

REMARKS

[1] The claims are amended in view of the Examiner's remarks. Withdrawal of the claim objection is requested.

[2-3] Claims 1-4 were rejected under § 103 over Liu '659. This rejection is respectfully traversed. Claim 1 is exemplified in the disclosure (starting at the bottom of page 14) as noted in brackets below:

A method for manufacturing a semiconductor element using Shallow Trench Isolation, comprising sequential steps of:

[Fig. 1A] forming, on a substrate [101] on which a protection oxide film [102] for protecting an active region and a nitride film [103] to be used as an etching stopper are formed in this order, an insulation film [104] for protecting the nitride film;

[Fig. 1A] etching the insulation film, the nitride film, the protection oxide film, and the substrate on the semiconductor element separation region to form a trench;

[Fig. 1B] etching the insulation film [104] to widen its aperture [by recession amount M] toward an inside of the active region;

performing a heat treatment to form a thermal oxidation film [106] inside the trench;

[Fig. 1C] etching the nitride film [103] using the insulation film with the widened aperture as a mask to move a step defined by the thermal oxidation film and the nitride film from an upper edge of the trench toward the inside of the active region;

[Fig. 1C] forming a filling oxide film [107] for burying the trench;

[Fig. 2A] selectively etching the filling oxide film [107] and the insulation film [104] to expose the nitride film [103];

[Fig. 2B] *etching the filling oxide film [107] inside the trench so that a surface of the substrate is substantially level with a surface of the filling oxide film; and*

[Fig. 2C] *removing the nitride film and the protection oxide film.*

The step of etching the nitride film using the insulation film with the widened aperture as a mask to move a step defined by the thermal oxidation film and the nitride film from an upper edge of the trench toward the inside of the active region, *after* the step of etching the insulation film to widen its aperture, is not disclosed by Liu.

Liu's claim 1 recites depositing an oxide layer over a nitride masking layer (col. 6, line 18) and forming a trench in the oxide and nitride layers and the substrate (col. 6, lines 1-24). This is illustrated in Fig. 3B, showing the nitride layer 106 removed by photolithography (col. 4, lines 53-62). The oxide layer 126 over the nitride layer 106 is shown in Fig. 3C. The trench 130, shown in Fig. 3D, is formed by a "process to remove portions of the first oxide layer 126 (Fig. 3C) *lying over the nitride masking layer 106 ... to form a trench 130 (FIG. 3D) ... while leaving an oxide spacer 134 disposed between the edges of the 120 and 122* " (col. 5, lines 9-14; emphasis added).

Thus, the oxide layer is removed while leaving the underlying nitride layer. This is completely contrary to the action of masking, in which both the mask and the underlying layer are retained.

Withdrawal of the rejection is requested.

[4-5] Claims 10-13 were rejected under § 103 over Doong. This rejection is respectfully traversed.

The Applicant illustrates in Figs. 5B-5C, and describes on page 22, an example of the subject matter of claim 10, which reads:

... forming an oxide film [307] to be used for forming spacers on a whole surface of the substrate and then forming oxide film sidewall spacers [308, 309 in Fig. 5C] having a step below the substrate surface by etching back the oxide film;

The oxide film 307 is etched back and the spacers 308, 309 are formed on the sidewalls of both the nitride film 303 and the trench 305. The spacers 308, 309 produce a step between themselves below the surface of the substrate 301.

Generally, a step causes a divot to form (e.g., prior-art Fig. 10B). However, in the Applicant's method the step is formed below the silicon substrate 301, so that no divot is formed.

In contrast to the Applicant's claims, Doong does not disclose two kinds of spacers. Doong's etch stop sidewall 36 (col. 3, line 24) is shown in all the figures as being unbroken from the top to the bottom of the trench.


Withdrawal of the rejection is requested.

[6] The allowance of claims 6-9 and 14-19 is noted with appreciation.

Respectfully submitted,

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Date



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